

Appl. No. : 10/737,315  
Filed : December 15, 2003

### REMARKS

In the Office Action mailed on April 20, 2005 the Examiner rejected all pending claims. Applicants respectfully request full consideration of the remarks contained herein.

#### Newly Added Claims

Applicants have added Claims 30 and 31, which recite that “the insulating layer comprises silicon oxide” and that “the contact via is formed in silicon oxide,” respectively. Support for this language can be found in the Application as originally filed. *See, e.g.*, the Application, p. 8-9. Consequently, Applicants respectfully submit that no new matter is added and that the added claims are fully supported by the Application as filed.

#### Rejections Under 35 U.S.C. § 102

The Examiner has rejected Claims 1-4, 8-11, 16-20, 22, 24 and 27-29 as being anticipated by Liu *et al.* (U.S. Patent No. 6,037,258).

Applicants respectfully traverse the rejections.

Initially, Applicants note that independent Claim 1 recites a lining layer disposed along surfaces of a trench and contact via, the “lining layer having a maximum thickness of less than about 100 Å and a step coverage of greater than about 90%.” Independent Claim 16 recites a metal nitride layer interposed between an upper insulating layer and a metal runner and interposed between the lower insulating layer and a metal contact, the “metal nitride layer having a maximum thickness of no more than about 200 Å on any surface.” Thus, particular levels of thickness uniformity are limitations of both independent claims.

Applicants also note that deposition techniques such as physical vapor deposition (PVD), or sputtering, have difficulties depositing thin layers having high thickness uniformity. As of the filing date of the Application, state-of-the-art PVD techniques required about 500 Å of metal to be deposited on a top surface of a trench in order for 50 Å of metal to reach the bottom and sidewalls of a dual damascene contact via having dimensions typical of modern integrated circuits. *See, e.g.*, the Application, pp. 3-4. Thus, the step coverage was about (50 Å)/(500 Å) or 10%. In response to shortcomings such as these, Applicants have developed a deposition technique which allows very uniform and thin lining layers to be formed on topographically complex structures, such as the surfaces of trenches and contact vias or the surfaces adjacent

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metal contacts and runners. The claims recite these advantageously uniform and thin lining layers.

Regarding the rejections of the claims, Applicants note that to anticipate a claim, *Liu et al.* must teach each and every limitation of that claim. The text of *Liu et al.* is silent concerning whether its sputtered barrier layer has Applicants' recited levels of step coverage and uniformity. For example, even if a layer were deposited to a thickness of 100 Å or less (Claim 1) or 200 Å or less (Claim 16), *Liu et al.* does not teach that these thicknesses can be maintained with high uniformity in the interior of both a trench and via, or in both the space adjacent a metal runner and in the space adjacent a metal contact. (Applicants note that, when the thickness for a layer is given, the skilled artisan understands that the thickness corresponds to the thickness on a top surface of a structure, *e.g.*, a trench, unless otherwise indicated.)

In view of these deficiencies, the Examiner has asserted that the figures of *Liu et al.* teach the recited high step coverage and high uniformity. However, as discussed in the M.P.E.P., "it is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue." M.P.E.P. §2125 (quoting *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956, 55 U.S.P.Q. 2d 1487, 1491 (Fed. Cir. 2000)). Consequently, because *Liu et al.* is silent regarding the step coverage and uniformity of its barrier layer and because *Liu et al.* does not indicate that the drawings are drawn to scale, Applicants submit that the Examiner has impermissibly relied upon the drawings to define the step coverage and uniformity of the barrier layer taught by *Liu et al.* Thus, because the Examiner may not rely upon the drawings to teach thickness uniformity or step coverage, Applicants submit that *Liu et al.* does not teach every limitation of independent Claims 1 and 16 and, so, does not anticipate independent Claims 1 and 16.

Moreover, Applicants submit that given the shortcomings of prior art deposition techniques, as discussed above, sputtering techniques, such as discussed in *Liu et al.*, cannot be assumed to give the high levels of step coverage and uniformity recited in Claims 1 and 16, respectively.

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**Rejection Under 35 U.S.C. § 103**

The Examiner has rejected Claims 5, 6-7, 12-15, 21, 23 and 25-26 under 35 U.S.C. § 103(a) as being unpatentable over Liu *et al.* in view of various secondary references. As discussed above, however, Liu *et al.* does not teach all that has been asserted. Liu *et al.* does not teach the particular levels of step coverage and uniformity recited in independent Claims 1 and 16. Furthermore, none of the secondary references teach or suggest such levels of step coverage and uniformity in conjunction with Liu *et al.* Because the obviousness rejections depend upon such asserted teachings, Applicants respectfully submit that the obviousness rejections are moot in view of the comments above.

Accordingly, Applicants respectfully submit that the pending claims are allowable over the art of record. Applicants have not specifically addressed the rejections of dependent claims as being moot in view of the remarks herein, nor have Applicants specifically addressed the asserted teachings of the art of record apart from Liu *et al.* However, Applicants expressly do not acquiesce in the Examiner's findings not addressed herein. Moreover, Applicants submit that the dependent claims recite further distinguishing and non-obvious features of particular utility.

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**CONCLUSIONS**

In view of the foregoing amendments and remarks, Applicants request entry of the amendments and submit that the application is in condition for allowance and respectfully request the same. If some issue remains which the Examiner feels may be addressed by Examiner's amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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